

What is claimed is:

1. A pharmaceutical dosage form comprising a layer of material bearing a microrelief that conveys information, said material being thermoformable and stable.
2. A pharmaceutical dosage form according to claim 1 wherein said pharmaceutical dosage form further comprises a core comprising a pharmaceutically active substance and said layer is a solid all covering or partially covering coating overlying said core and said information is a holographic image or effect.
3. A pharmaceutical dosage form according to claim 2 wherein said microrelief in said layer controllably responds to temperature and humidity acting on said layer so that a visible change in said holographic image or effect is an indication of exposure to excessive heat and/or humidity.
4. A pharmaceutical dosage form according to claim 2 or 3, in the form of a tablet.
5. A pharmaceutical dosage form according to claim 2 or 3, in the form of a capsule.
6. A pharmaceutical dosage form according to claim 1, in which the microrelief is a diffraction grating.
7. A pharmaceutical dosage form comprising:  
a core which comprises a pharmaceutically active substance and a pharmaceutically acceptable carrier;  
a thermoformable solid outer layer overlying said core, and a microrelief in said layer..
8. A pharmaceutical dosage form according to claim 7, wherein said microrelief is a diffraction grating.
9. A pharmaceutical dosage form according to claims 8 wherein said outer layer completely covers said core.
10. A dosage form according to claims 8, wherein said outer layer partially covers said core.
11. A pharmaceutical dosage form according to claim 7 wherein in said layer is formed from an aqueous solution of a thermoformable material selected from the group of modified cellulose, modified food starch, gelatin, waxes or vegetable gums and combinations thereof.
12. A pharmaceutical dosage form according to claim 11 wherein said modified cellulose is selected from the group consisting of hydroxypropylmethylcellulose (HPMC), hydroxypropylcellulose (HPC), and mixtures thereof.

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13. A pharmaceutical dosage form according to claim 12 wherein said layer constitutes in the range of 0.25 - 5.0%, by weight, of said pharmaceutical dosage form.

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14. A pharmaceutical dosage form according to claims 8 or 9 wherein said outer layer is applied by printing or laminating.

15. A pharmaceutical dosage form according to claim 14, wherein said outer layer is adhered to said core by a heat-fused or chemical bond.

16. A pharmaceutical dosage form according to claim 15, wherein said bond is made from an HPMC or HPC contact layer, wax, vegetable gum, modified food starch, or mixtures thereof.

17. A pharmaceutical dosage form according to claim 7 or 11, wherein said layer forms an edible capsule that holds said core.

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18. A pharmaceutical dosage form according to claim 1 which consists essentially of said layer and, absorbed therein, a pharmaceutically active substance.

19. A pharmaceutical dosage form according to claims 9 and 10 wherein said outer layer comprises at least one food grade material selected to controllably display the effects of heat and/or humidity on said microrelief.

20. A pharmaceutical dosage form according to claim 19 wherein said at least one of said materials is a low melting point wax.

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21. A pharmaceutical dosage form according to claim 18 wherein said at least one food grade material retards the effects of heat on the holographic image or effect produced by said microrelief a high melting point wax.

22. A pharmaceutical dosage form according to claims 8 or 9 wherein said solid outer layer formed of food grade materials selected to controllably display the effects of moisture on the microrelief.

23. A pharmaceutical dosage form according to claim 22 wherein said at least one food grade material that responds to display the effects of moisture on the holographic image or effect produced by said microrelief is selected from the group consisting of a highly hygroscopic sugar and such as dextrose or a plasticizer such as propylene glycol.

24. A pharmaceutical dosage form according to claim 22 wherein said food grade material retards the effects of moisture and comprises a low hygroscopic modified cellulose.

25. A pharmaceutical dosage form according to claim 4 in which the outer configuration of the core reduces twinning during pan-coating.

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26. A pharmaceutical dosage form according to claim 25 in which the modification is comprises a reduction in the amount of flat areas on the core.
27. A pharmaceutical dosage form according to claim 26 in which the modification comprises said core having at least one convexly curved face of not less than .6 radians.
28. A pharmaceutical dosage form according to claim 26 wherein the core also has a recess formed thereon, said recess having a generally planar bottom surface.
29. A method of producing a microrelief on an ingestible dosage form having a core which can contain a pharmaceutically active substance and a pharmaceutically acceptable carrier, comprising the steps of:
  - a. coating said core with a layer of a thermo-formable material that can receive and retain a holographic diffraction pattern;
  - b. providing a plate having a holographic diffraction pattern formed on at least a portion of a first surface thereof;
  - c. transporting said coated cores to a position opposite said first surface;
  - d. heating at least one of said plate and said coating during or prior to the time when they are in said opposed relationship;
  - e. pressing said first surface into said coating to replicate said holographic diffraction pattern in said coating;
  - f. cooling said coating thus replicated; and
  - g. demolding said first plate surface from said coating.
30. The holographic dosage form production method of claim 29 wherein said coating is pan coating and further comprising the step of controlling twinning of said coated tablets.
31. The holographic dosage form production method of claim 30 wherein said twinning control comprises forming said core with at least one curved face that receives said coating and said pressing.
32. The holographic dosage form production method of claim 31 wherein said curvature is sufficient to resist twinning, but not sufficient to distort the holographic image pressed into in said coating.
33. The holographic dosage form production method of claim 32 wherein said core face is generally circular and, measured as an angle in a plane through the face, the curvature is in the range of about 0.6 radian to about 0.9 radian.

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34. The holographic dosage form production method of claim 30 wherever said twinning control comprises forming said core with a recess within at least one face of said coat, said recess having a generally flat bottom that receives said coating layer.

35. The holographic dosage form production method of claim 34 wherein said recess is sufficiently shallow that said pressing transfers said holographic pattern reliably.

36. The holographic dosage form production method of claim 42 wherein said recess is less than about 0.01 mm.

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37. The diffractive dosage form production method of claim 29 wherein said coating includes said thermo-formable material bonding reliably with said core.

38. The holographic dosage form production method of claim 29 or 37 wherein said thermo-formable material selected from the group consisting of: gelatin, hydroxypropylmethylcellulose (HPMC), hydroxypropylcellulose (HPC), modified food starches, waxes, vegetable gums and combinations thereof.

39. The holographic dosage form production methods of claim 38 wherein said material includes solids of a modified cellulose, a plasticizer, and a colorant.

40. The holographic dosage form production method of claim 38 wherein said coating produces a layer in the range of 0.25% to 7.25% of the weight of said dosage form.

41. The holographic dosage form production method of claim 29 wherein said plate providing comprises continuously advancing a belt of a semi-flexible material containing said pattern on at least one surface thereof in coordinating with said transporting of said coated dosage forms.

42. The holographic dosage form production method of claim 41 wherein said semi-flexible material is selected from the group consisting of: a thin sheet metal, rubber, a laminate of thin sheet metal and a layer of a resilient backing material opposite said first surface, and a rubber and metal composite.

43. The holographic dosage form production method of claim 42 wherein said thin sheet metal is a nickel composite with a thickness of 1 mils to 5 mils, and said holographic diffraction pattern is electroformed on said first surface.

44. The holographic dosage form production method of claims 29 and 41 wherein said transporting also aligns said coated cores.

45. The holographic dosage form production method of claims 41 or 43 wherein said coated core facing said plate during said pressing is non-planar, and said belt

flexibility is sufficient to allow said belt to conform to said non-planar coating desiring said pressing.

46. The holographic dosage form production method of claim 41 wherein said transporting comprises conveying of a linear array of said coated cores in a parallel, closely spaced relationship with a portion of said belt, and moving said belt in coordination with said conveying.

47. The holographic dosage form production method of claim 46 wherein said heating is a rapid, localized heating of said belt during said pressing.

48. The holographic dosage form production method of claim 47 wherein said heating raises the temperature of said diffraction pattern on said belt to a temperature in the range of 90 - 150 °C.

49. The holographic dosage form production method of claim 47 wherein said pressing comprises a brief deflection of said heated belt that places said diffraction pattern in said coating to create said replication of said diffraction pattern in said coating.

50. The holographic dosage form production method of claims 29 and 47 wherein said pressing occurs for about 0.3 to 3.0 second.

51. The holographic dosage form production method of claim 46 wherein said cooling is a rapid, localized cooling that begins immediately after said pressing has formed said diffraction pattern in said coating.

52. The holographic dosage form production method of claim 51 wherein said demolding comprises a resumption of said mutually spaced relationship between said coating as said coated and said belt as they continue to move in coordination, after said cooling has begun.

53. Apparatus for the continuous production of a hologram on an ingestible dosage form having a core which can contain a pharmaceutically active substance and which has been coated with a thin layer of a thermo-formable, comprising,  
a conveyor that carries the coated cores in a first direction,  
a plate containing a holographic diffraction pattern on one surface thereof facing the coated cores on said conveyor, said plate being movable along said first direction in coordination with said carrying of said conveyor and with said one surface spaced from said coated cores,  
a heater for rapidly raising the temperature of one of said plate and said coating to a level where said coating is formable, apparatus for pressing said one surface into said coating after said heating to replicate said diffraction pattern on

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said coating,

a cooler to rapidly lower the temperature of said coating to stabilize said diffraction pattern in said coating, and

apparatus to separate said one surface from said coating.

54. The apparatus of claim 53 wherein said plate comprises an continuous belt of a semi-flexible material with said one surface facing outwardly.
55. The apparatus of claim 54 wherein said diffraction pattern is formed on at least portions of said one surface.
56. The apparatus of claim 54 wherein said conveyor includes means for holding said coated cores in a pre-selected array and said diffractive pattern is formed on raised or recessed portions of said belt that align with said coated cores during said pressing.
57. The apparatus of claim 54 wherein said belt is formed of a material selected from the group consisting of: thin sheet metal, rubber, thin sheet metal with a backing layer of a resilient material, or mixtures thereof.
58. The apparatus of claim 54 wherein said separating apparatus comprises at least one guide member positioned to direct at least one of said belt and said conveyor to separate from another to help in demolding.
59. The apparatus of claim 53 wherein said heater comprises a source of radiant electromagnetic energy directed before said pressing apparatus at one of said belt and said thin layer facing said belt.
60. The apparatus of claim 53 wherein said cooler comprises a jet of a refrigerated fluid directed onto said belt following said pressing.
61. The apparatus of claim 53 wherein said pressing apparatus comprises belt guides that deflect a portion of said belt into said thin layer following passage through said heater.
62. The apparatus of claim 53 wherein said pressing apparatus comprises an actuator disposed after said heater to reciprocate into and out of contact with said belt opposite said first surface to print said diffraction pattern in said coating.